one adjustment of the clamp positioning the socket members in a opposing relationship on either side of the coupling member and relatively rotatable thereto, and

another adjustment of the clamp positioning the socket members in a opposing relationship on either side of the coupling member and compressing the radially compressible material thereof, whereby the socket members substantially compress the coupling member and interlock the socket members with the coupling member in a relative angular orientation.

61. (New) The interlocking ball and socket joint of claim 60, wherein the structure formed in the smooth, concave socket surface further comprises an indentation.

REMARKS

Claims 1-56 remain in the case. Claims 1-37 are deemed Allowable over the prior art. Claims 43, 50 and 52-56 are amended. Additional claims 57-61 are newly presented.

The Examiner is thanked for acknowledging the preliminary amendment filed on December 7, 2000.

Claim Rejections Under 35 USC § 112

Claims 52-56 were rejected under 35 USC § 112, second paragraph, as being indefinite.

The Office Action requires clarification of the subject of lines 3-4 of claim 52. Lines 3-4 of claim 52 recite, "mechanically fixing a substantially globular structure of sturdy but compressible material around a first end of an elongated rigid mechanical structure having first and second ends."

The language of claim 52 as originally drafted is believed to comply with 35 USC § 112, second paragraph. The "elongated rigid mechanical structure" recited in lines 3-4 is the "reduced diameter neck 46" portion of one of the couplers 100 and 102, which are best viewed in Figures 1 and 2. The couplers 100, 102 are each described in the Specification as comprising a "disc-shaped base 47 and 48, respectively, with a reduced diameter neck 46 relatively upstanding thereon, and a ball shaped head 22 and 24, respectively, upstanding in turn on the neck." Col. 11, lines 60-64.

The meaning of the mechanical structure recited in lines 3-4 is further clarified by lines 6-7 of claim 52, wherein "the second end of the rigid mechanical structure" is adapted "to accept a mechanical attachment thereto." As described in the above referenced portion of the original Specification, the couplers 100 and 102 "each comprise a disc-shaped base 47 and 48" as one means for being adapted to accept a mechanical attachment thereto. Col. 11, lines 60-61. The Examiner will readily recognize that the broader claim description of "adapting" the second end to accept mechanical attachment thereto, while inclusive of the disc-shaped base 47, 48, is inclusive of other adaptations as are known in the art.

The "substantially globular structure of sturdy but compressible material around a first end" of the coupler 100, 102 is a respective one of the ball shaped heads 22 and 24 that are "upstanding on the neck" 46 portion, and are formed of "a pressure deformable elastomeric material in the body thereof, which renders the head (22, 24) relatively radially compressible." Col. 11, lines 62-67.

Additionally, the "socket surfaces" that are disposed "about the globular structure" at line 7 of claim 52 are not associated with the "elongated rigid mechanical structure" referred to in lines 3-4. Rather, the "globular structure" of lines 3-4 is fixed around a first end of a rigid mechanical structure and intervenes between the rigid mechanical structure and the socket surfaces. As described in the Specification, the "respective heads 22, 24 are sized so that the radii thereof are approximately equal to those of the inner peripheral surfaces of the sockets 25 and 26, and in the operation of the device 10, the sockets 25 in the end portions 3 of the arm sections 16, 18, are engaged about the head 22 of the coupler 100 so as to form a ball and socket joint 43 (FIG. 4) therebetween." Col. 12, lines 5-11.

Furthermore, the Applicant has amended the preamble of claim 52 to more particularly point out the subject matter which the Applicant regards as invention. The Applicant also deleted the limitation "elongated" from claim 52 because it is unnecessary for the patentability of the invention.

For each of the above reasons claim 52 as originally filed is believed to comply with the requirements of 35 USC § 112, second paragraph, by particularly pointing out and distinctly claiming the subject matter which the Applicant regards as the invention. The Applicant

therefore declines at this time to amend the language of claim 52 as regards the rejection under 35 USC § 112, second paragraph, and respectfully requests reconsideration and allowance of the invention as recited in claim 52.

While claim 56 is different in scope from claim 52, the above arguments directed to claim 52 are sufficiently applicable to claim 56 as to make repetition unnecessary. Thus, for each of the reasons above, the Applicant believes that claim 56 as originally filed and amended herein complies with the requirements of 35 USC § 112, second paragraph. The Applicant therefore declines at this time to further amend the language of claim 56 as regards the rejection under 35 USC § 112, second paragraph, and respectfully requests reconsideration and allowance.

Claims 53-55 are amended to more distinctly set forth steps involved in the method of the claimed invention.

Claim Rejections Under 35 USC § 103

Claims 38-42, 44-49, and 51-56 were rejected under 35 USC § 103(a) as being obvious over US Patent 180,881 to Howson in view of US Patent 5,441,225 to Hall.

The invention recited in claim 38 is patentable over Howson and Hall, both individually and in combination. Howson teaches a pair of "elastic or yielding" arms *h*, *h* each forming part of a socket portion of a ball-and-socket support. A ball *D* is captured in the socket, and the two arms *h*, *h* are tightened together to firmly grip the ball *D*. Col. 1, paragraphs 4-6. The ball *D* portion of the ball-and-socket is formed of iron. Col. 4, lines 4-8. Howson therefore teaches using the resilience of the arms *h*, *h* to grip the incompressible ball *D*.

Hall, on the other hand, fails to teach a any ball. Rather, Hall teaches a "ball-like" element 22 formed of three orthogonal elements 23, 24, 25 each having a circular profile that are joined together to form an "overall spherical profile." Col. 4, lines 21-25. The orthogonal elements are formed of polyurethane. Col. 3, lines 37-41.

The Howson and Hall references cannot be combined to teach the "the first and second coupling members having a substantially smooth part spherical outer surface formed of resilient radially compressible material" as recited in claim 38 of the present invention. Neither

Howson nor Hall provides any suggestion that the two references can be combined to provide this element. Rather, both Howson and Hall teach directly away from the combination.

Howson specifically teaches a ball *D* having a solid spherical surface and being formed of an unyielding metallic substance, *e.g.*, iron. Figure 1; and col. 4, lines 4-8. The solid surface of the ball *D* is necessary so that the two resilient arms *h*, *h* can "firmly grip the ball." Howson thus specifically teaches away from both the compressibility and the open surface of the "ball-like" element of Hall that limits the surface engagement with the socket.

In stark contrast to Howson, Hall specifically teaches a "ball-like" 22 element, rather than a ball. The ball-like 22 element must be formed of three orthogonal elements 23, 24, 25 formed of an elastic material. The three orthogonal elements 23, 24, 25 ensure a "noncontinuous surface" that "allows a limited degree of frictional movement." Col. 4, lines 47-53.

Hall substituted the orthogonal elements 23, 24, 25 for a solid ball for several reasons. First, the orthogonal configuration "allows the ball to be fabricated with closer tolerance on its external periphery" than would be possible with a solid ball. Col. 3, lines 37-44. Next, a solid ball would be "extremely difficult to fabricate with a smooth, external profile due to the inherent nature of a plastic part of any appreciable thickness to shrinkage and 'dimpling' upon cooling." Col. 3, lines 44-55. Thirdly, the orthogonal configuration allows easier adjustment with the socket because of the reduced contact area results in reducing the frictional forces over those encountered if the ball were solid. Col. 3, lines 56-63. Therefore, even when held in "snug, frictional engagement," the ball can be turned relative to the socket. Col. 3, line 64-col. 4, line 4; and col. 4, lines 36-39. In contrast, a ball with a solid surface would be in either a free turning relationship with the socket or fixed, while the orthogonal configuration permits a limited degree of relative movement. Col. 4, lines 47-53. This last is an important feature of the ball-like element of the Hall invention. Col. 4, lines 40-53.

Hall thus specifically teaches away from the solid spherical surface of the ball *D* as taught by Howson that maximizes the surface engagement with the socket to "firmly grip the ball." Howson at col. 1, last paragraph. See, *e.g.*, Hall at col. 3, lines 56-63, where Hall specifically argues the benefits of the orthogonal elements over a ball.

Hall also teaches away from the incompressible material, *e.g.*, iron, of Howson's ball *D*, by teaching instead a configuration of orthogonal elements that are formed of a deformable substance. e.g., polyurethane. Col. 3, lines 44-50.

Since Howson and Hall both teach away from the art of the other, neither can suggest combining the two references. Furthermore, the teaching of Howson away from Hall and the teaching of Hall away from Howson makes Howson and Hall an improper combination of references under 35 USC § 103(a).

Furthermore, even if the Howson and Hall reference were a proper combination, which they are not, the invention recited in claim 38 is patentable over both Howson and Hall, either alone or in combination.

The Examiner admits and the Applicant agrees that Howson does not teach the coupling members of claim 38 being formed of "substantially smooth part spherical outer surface formed of resilient radially compressible material." Rather, Howson teaches a ball *D* having a solid spherical surface and being formed of an unyielding metallic substance, *e.g.*, iron. Figure 1; and col. 4, lines 4-8. Howson instead relies on the resilience of the clamping arms *h, h*. Col. 1, paragraphs 5-6.

By teaching a ball formed of an unyielding metallic substance held between resilient arms, Howson cannot logically teach "a second clamped together position having the first sockets positioned to radially compress and interlock with the outer surface of the first coupling member, and having the second sockets and the second coupling member form a second relatively rotatable ball and socket joint," as recited in claim 38. Rather, at col. 1, paragraph 5, Howson teaches that the arms *h, h* into which the sockets are built provide the elastic yielding, instead of the ball being radially compressible, as recited in claim 38.

For the same reasons Howson fails to teach "a third clamped together position having the first sockets positioned to radially compress and interlock with the outer surface of the first coupling member, and having the second sockets positioned to radially compress and interlock with the outer surface of the second coupling member," as also recited by claim 38.

Hall fails to provide the deficiencies of the Howson reference. Hall fails to teach "first and second coupling members having a substantially smooth part spherical outer surface

formed of resilient radially compressible material," as recited in claim 38. In fact, Hall fails to provide any element having a "substantially smooth part spherical outer surface" as recited in claim 38. Rather, Hall provides only a orthogonal combination of circular elements 23-25 with "generally trihedral" spaces therebetween. Col. 4, lines 22-31.

Furthermore, the orthogonal combination of circular elements 23-25 provided by Hall cannot be "radially compressed" and fails to "interlock," as recited in claim 38. The orthogonal circular elements 23-25 are inherently unable to be "radially compressed," as recited by claim 38. The orthogonal elements 23-25 are described as generally planar. See, Figure 1. When compressed between the socket elements 32, 34, the generally planar orthogonal elements 23-25 must inherently collapse in a complex bending mode, rather than "radially," as recited in claim 38.

Additionally, the orthogonal combination of circular elements 23-25 are taught by Hall to have "generally trihedral" spaces therebetween, rather than a solid surface, so that the tendency to "seize" or "interlock" is minimized. Col. 4, lines 22-39. This feature is "important" to the operation of the Hall invention. Col. 4, line 40. Hall actually teaches away from a solid ball surface so that a "stuck" or "interlocked" relationship will not occur. Col. 4, lines 47-49. Rather, the orthogonal elements 23-25 taught by Hall permit a "limited degree of frictional movement."

For the same reasons Hall also fails to provide either "a second clamped together position having the first sockets positioned to radially compress and interlock with the outer surface of the first coupling member, and having the second sockets and the second coupling member form a second relatively rotatable ball and socket joint," or "a third clamped together position having the first sockets positioned to radially compress and interlock with the outer surface of the first coupling member, and having the second sockets positioned to radially compress and interlock with the outer surface of the second coupling member," both recited by claim 38.

For each of the above reasons, claim 38 is allowable over the Howson and Hall references, both individually and in combination.

Claim 39 is different in scope from claim 38. However, the above arguments directed to claim 38 are sufficiently applicable to claim 39 as to make repetition unnecessary. Thus, for each of the reasons above, claim 39 is believed to be allowable over the cited art. Claims 40-42 and 44-46 are allowable as depending from allowable claim 39.

Claim 47 is different in scope from claims 38 and 39. However, the above arguments directed to claim 38 are sufficiently applicable to claim 47 as to make repetition unnecessary. Thus, for each of the reasons above, claim 47 is believed to be allowable over the cited art. Claims 48-49 and 51 are allowable as depending from allowable claim 47.

Claim 52 is different in scope from claims 38, 39 and 47. However, the above arguments directed to claim 38 are also sufficiently applicable to claim 52 as to make repetition unnecessary. Thus, for each of the reasons above, claim 52 is believed to be allowable over the cited art. Claims 53-56 are allowable as depending from allowable claim 52.

Allowable Subject Matter

The Examiner is thanked for notifying the Applicant that claims 1-37 are allowed. The Examiner is also thanked for notifying that claims 43 and 50 contain allowable subject matter and will be allowable when rewritten in independent form, including the limitations of the base claim and any intervening claims.

Claims 43 and 50 are rewritten and are now allowable.

New claims 57-61 are presented for consideration. While differing in scope, newly presented dependent claims 57 and 58 are fashioned after allowable claims 43 and 50 and are believed to be allowable over the cited art. New claims 57 and 58 are further allowable as depending from allowable claim 52.

While differing in scope, newly presented independent claims 59 and 60 are fashioned after allowable claims 43 and 50, respectively, and are believed to be allowable over the cited art. New claim 61 is allowable as depending from allowable claim 60.

The claims now being in form for allowance, reconsideration and allowance is respectfully requested.

For the Examiner's convenience, an Attachment hereto shows the amended claims, including the changes thereto.

If the Examiner has questions or wishes to discuss any aspect of the case, the Examiner is encouraged to contact the undersigned at the telephone number given below.

Respectfully submitted,

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Attachment Sh wing Changes to Claims

43. (Once Amended) ~~The interlocking ball and socket joint of claim 42, wherein~~ An interlocking ball and socket joint comprising:

a coupling member partially formed of a resilient deformable material in a substantially smooth spherical shape having an unconstrained diameter and substantially encompassing a substantially rigid mechanical core adapted to accept a mechanical attachment outside the unconstrained diameter;

a socket having first substantially smooth and rigid opposing concave interior surfaces shaped to substantially conform to the substantially spherical portion of the coupling member, one of the smooth concave surfaces ~~further comprises~~ having an indentation formed therein; and

an adjustable clamp disposed subsequently in a plurality of different adjustment relationships to the opposing concave socket surfaces,

one adjustment of the clamp conforming the first opposing interior socket surfaces in a relatively rotational relationship with the coupling member, wherein the opposing interior socket surfaces partially encompass a spherical volume having substantially the same diameter as the substantially spherical portion of the coupling member, whereby the socket and the coupling member are relatively rotatable, and

another adjustment of the clamp conforming the first opposing interior socket surfaces in an interlocking relationship with the coupling member, wherein the opposing interior socket surfaces partially encompass opposing spherical segments of the coupling member that are spaced apart a distance that, combined with a height of each of the opposing spherical segments, is less than the unconstrained diameter of the substantially spherical portion of the coupling member, whereby the socket deforms the coupling member and interlocks the socket and the coupling member in a relative angular orientation.

50. (Once Amended) ~~The interlocking ball and socket joint of claim 49, wherein~~ An interlocking ball and socket joint comprising:

a coupling member having a radially compressible material formed in a substantially spherical shape having an uncompressed outer diameter, the radially compressible material being formed around and rotationally fixed to a relatively rigid core having a projection extending outside of the unconstrained diameter;

a socket adapted to accept a mechanical attachment and comprising two or more substantially rigid socket members each having substantially smooth concave radial surfaces having radii substantially identical to the radius of the uncompressed outer diameter of the coupling member, the surfaces coextending with a portion of the uncompressed outer diameter of the spherical portion of the coupling member, one of the smooth concave surfaces ~~further comprises~~ having an indentation formed therein; and

an adjustable clamp mechanically attached to the socket members and subsequently positioning the socket members in a plurality of opposing relationships to one another,

one adjustment of the clamp positioning the socket members in a opposing relationship on either side of the coupling member and relatively rotatable thereto, and

another adjustment of the clamp positioning the socket members in a opposing relationship on either side of the coupling member and compressing the radially compressible material thereof, whereby the socket members substantially compress the coupling member and interlock the socket members with the coupling member in a relative angular orientation.

52. (Once Amended) A method of forming a universally positionable device for fixing relative angular orientation between a ball and a socket, the method comprising:

mechanically fixing a substantially globular structure of sturdy but compressible material around a first end of ~~an elongated~~ a rigid mechanical structure having first and second ends;

adapting the second end of the ~~elongated~~ rigid mechanical structure to accept a mechanical attachment thereto; and

disposing two opposing socket surfaces about the globular structure, the two opposing socket surfaces adapted for disposing in a first relatively rotational relationship thereto and a

second angularly fixed relationship thereto, wherein the compressible material is compressed between the two opposing socket surfaces.

53. (Once Amended) The method of claim 52, wherein ~~the globular structure is formed with~~ mechanically fixing a substantially globular structure of sturdy but compressible material around a first end of an rigid mechanical structure further comprises forming the globular structure having an uncompressed radius substantially identical to one of the two opposing socket surfaces.

54. (Once Amended) The method of claim of claim ~~53, further comprising~~ 52, wherein mechanically fixing a substantially globular structure of sturdy but compressible material around a first end of an rigid mechanical structure further comprises forming the globular structure ~~formed~~ with a substantially smooth surface.

55. (Once Amended) The method of claim of claim ~~54, wherein each of the interior socket members further comprises~~ 52, wherein disposing two opposing socket surfaces about the globular structure further comprises forming each of the two opposing socket surfaces as substantially smooth and rigid concave surfaces.

56. (Once Amended) The method of claim of claim ~~55~~ 52, further comprising:

mechanically fixing a second substantially globular structure of sturdy but compressible material around a first end of a second ~~elongated~~ rigid mechanical structure having first and second ends;

adapting the second end of the second ~~elongated~~ rigid mechanical structure to accept a mechanical attachment thereto; and

disposing two opposing second socket surfaces about the second globular structure, the two opposing second socket surfaces adapted for disposing in a first relatively rotational relationship thereto and a second angularly fixed relationship thereto, wherein the compressible material is compressed between the two opposing second socket surfaces.

57. (New) The method of claim of claim 52, wherein disposing two opposing socket surfaces about the globular structure further comprises forming an artifact within an interior surface of at least one of the two opposing socket surfaces.

58. (New) The method of claim of claim 57, wherein forming an artifact within an interior surface of at least one of the two opposing socket surfaces further comprises forming an indentation within the interior surface of the socket surface.

59. (New) An interlocking ball and socket joint comprising:

a coupling member partially formed of a resilient deformable material in a substantially unbroken globular shape having an unconstrained diameter and substantially encompassing a mechanical core adapted to accept a mechanical attachment outside the unconstrained diameter;

a socket having first substantially opposing interior surfaces shaped to substantially conform to the substantially globular portion of the coupling member, one of the interior surfaces being a smooth concave surfaces having an indentation formed therein;

an adjustable clamp disposed subsequently in a plurality of different adjustment relationships to the opposing concave socket surfaces,

one adjustment of the clamp conforming the first opposing interior socket surfaces in a relatively rotational relationship with the coupling member, wherein the opposing interior socket surfaces partially encompass a spherical volume having substantially the same diameter as the globular portion of the coupling member, whereby the socket and the coupling member are relatively rotatable, and

another adjustment of the clamp conforming the first opposing interior socket surfaces in an interlocking relationship with the coupling member, wherein the opposing interior socket surfaces partially encompass opposing spherical segments of the coupling member that are spaced apart a distance that, combined with a height of each of the opposing spherical segments, is less than the unconstrained diameter of the globular portion of the

coupling member, whereby the socket deforms the coupling member and interlocks the socket and the coupling member in a relative angular orientation.

60. (New) An interlocking ball and socket joint comprising:

a coupling member having a radially compressible material formed in a substantially unbroken spherical shape having an uncompressed outer diameter and formed around a relatively rigid core having a projection extending outside of the unconstrained diameter;

a socket adapted to accept a mechanical attachment and comprising two or more substantially rigid socket members each having substantially smooth concave surfaces coextending with a portion of the uncompressed outer diameter of the spherical portion of the coupling member, one of the smooth concave surfaces having a structure formed therein; and

an adjustable clamp mechanically attached to the socket members and subsequently positioning the socket members in a plurality of opposing relationships to one another,

one adjustment of the clamp positioning the socket members in a opposing relationship on either side of the coupling member and relatively rotatable thereto, and

another adjustment of the clamp positioning the socket members in a opposing relationship on either side of the coupling member and compressing the radially compressible material thereof, whereby the socket members substantially compress the coupling member and interlock the socket members with the coupling member in a relative angular orientation.

61. (New) The interlocking ball and socket joint of claim 60, wherein the structure formed in the smooth, concave socket surface further comprises an indentation.